Risk Management Plan

for the

National Oceanic and Atmospheric Administration (NOAA)

Geostationary Operational Environmental Satellite – R (GOES-R) Series

January 2004

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Page No.	**Revision**	**Page No.**	**Revision**	**Page No.**	**Revision**

Table of Contents

List of Figures

List of Tables

Section 1 Introduction

1.1 Background

Risk is characterized by the combination of the probability or likelihood that the program will experience an event and the consequences, impact, or severity of the event, were it to occur. Risk Management (RM) is a continuous, iterative, and proactive process to manage risk and achieve mission success. The process involves identifying, analyzing, planning, tracking, controlling, documenting, and communicating risks effectively. RM begins in the End-to-End Systems Architecture Definition phase and continues through the operations and disposal phase with the disposition and tracking of existing and new risks.

This document establishes the RM Plan for the NOAA National Environmental Satellite, Data, and Information Service (NESDIS), Office of Satellite Development (OSD) GOES-R Series Program. The NOAA GOES-R Series Program will utilize RM as a decision-making tool to ensure safety and to enable programmatic success. Decisions will be made based on an orderly risk management effort that includes the identification, assessment, mitigation, and disposition of risks throughout the program's life cycle. Applying the RM process also ensures that risk communication and documentation are maintained across the program.

The GOES-R Series Program Manager (PM) is taking a proactive approach to managing risk. In the initial planning phases, risk identification will be initiated and will continue throughout the GOES-R Series Program life cycle with the goal to reduce unexpected events that require workarounds, contingency or fallback plans, and additional funding. It is anticipated that changes and improvements will be necessary over time as the risk management process is further defined and implemented by the program. This plan has been prepared for the NOAA GOES-R Series Program for all mission phases including End-to-End Systems Architecture Definition, Design/Risk Reduction (DRR), System Development/Production (SD/P), Sustainment/Operations, and Disposal.

This process is fundamentally iterative, proactive and contains critical feedback loops to allow for the communication of risk at all levels of the program organization. Management approaches to addressing one or more risks may be substantially revised depending on the degree of success of ongoing risk mitigation efforts or on the phase of the program lifecycle. In order to allow this flexibility, the risk management process requires continuous access to many different types of information, systematic monitoring and tracking of each successive step and wide communication across the entire program. The process itself must evolve as the NOAA GOES-R Series Program evolves, incorporating additional refinements, tools and metrics to address the successive phases of the program.

1.2 Program Mission Description

The GOES-R Series satellites are being designed to meet NOAA's mission objectives for continuous observations of atmospheric, space, and coastal environmental events. The GOES-R Series system along with the Polar-orbiting Operational Environmental Satellite (POES) will provide an observation system that produces reliable data on atmospheric, terrestrial (land), fresh water, and ocean ecosystems. The system provides NOAA global coverage and will be key in the World Meteorological Organization Earth Observing System (WMO-EOS) suggested at the Earth Observation Summit (July 2003).

GOES satellites provide an uninterrupted flow of data processed through a ground infrastructure to forecasters of the National Weather Service (NWS), to other NOAA organizations/interests, and other international, federal, state, and local governments, universities, and private organizations. The data are processed and assimilated into numerical forecast models that enhance forecasts ranging temporally from daily to extended forecasts to issuance of severe weather early watches and warnings well in advance of their occurrence. Planned GOES improvements in the GOES-R timeframe will significantly enhance NOAA's ability to meet the short-term weather needs (improved weather event lead-times and more distinct affected areas) by advancing sensor sensitivity to the detection of atmospheric moisture and improving the understanding of storm development of derived winds. These improvements support the evolution of more dynamic numerical modeling that enhances forecasting accuracy. The GOES-R Series acquisition consists of Spacecraft/Launch Vehicle, Instruments, and equipment for the following:

atmospheric, solar, ground, and ocean environmental measurements through imaging, sounding and solar sensors; water (streams and rivers) level data collection; GOES data rebroadcast; command, control and communications (C3); product generation and distribution (PGD), archive & access (AA), and user interface/assimilation. The GOES-R improvements directly support NOAA's mission, "to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs." The first launch is scheduled for 2012 and the system is programmed to be operational through 2029.

1.3 Purpose and Scope

The purpose of this document is to describe the overall process, procedures, organizational roles, and tools that will be used to support this effort. The GOES-R Series Risk Management Plan (RMP) is intended to complement the overall NOAA GOES-R Series Program Management of which RM will be an integral part.

This plan establishes the process for managing risks during all phases of the GOES-R Series Program. The GOES-R Series Program consists of the Spacecraft/Launch Vehicle, Instruments, C3, PDG, AA, User Interface/Assimilation and their constituent elements, subsystems, functions, and operations. The scope of this plan also includes risks associated with the use of program (Government and Contractor) financial resources, facilities, procedures, equipment and personnel (civil servants, contractors, material developers, instrument developers, researchers, etc.) that have been assigned to or are directly associated with the GOES-R Series Program.

1.4 Assumptions, Constraints, and Policies

1.4.1 Assumptions

- Individuals, functional teams, developers, and other affiliated organizations play a significant role in the GOES-R Series Program throughout all of phases of the mission. For this reason, the risk management process is built around the significant participation of these individuals, teams and organizations working in concert on this program.

- It is not expected that additional funding or schedule relief will be provided to the GOES-R Series Program for risk mitigation activities, even for high-level risks. It must be assumed that such mitigations must in all cases be funded and scheduled through the use of resources already allocated to the GOES-R Series Program. It is therefore imperative that the distribution of essentially fixed financial resources be optimized across a number of risks in order to limit total program risk exposure.

- Increasing attention on risk-related issues will continue. The emphasis on RM in management reviews and requests for more detailed, lower level risk information in communications with stakeholders and customers as represented by the GORWG, sponsors, and senior level management will continue.

- Space and ground segment End-to-End Architecture Definition, DRR and SD/P will continue along parallel development timelines.

- Launch vehicle: Nominal launch vehicle for the notional distributed architecture baseline is an Evolved Expendable Launch Vehicle – Medium (EELV-M) class vehicle capable of co-manifesting two satellites per launch. Launch vehicles are currently available through Lockheed Martin and Boeing. The launch vehicle will be provided as Government Furnished Equipment (GFE).

1.4.2 Constraints

- Design, development, and delivery schedules are essentially constrained by launch in the 2012 timeframe.

- Baseline Budget limits and funding profiles.

- International contributions and exchanges must be conducted under International Traffic in Arms Regulations (ITAR).

- The GOES-R Series Program segment developers, materials developers, and other affiliated organizations will operate under separate RMPs as required in existing agreements, contracts, or other documentation and will interface with the GOES-R Series Program RM process as described in this plan. These plans are constrained to be compatible with the GOES-R Series Program RMP.

- Existing technological, funding, and schedule constraints will not allow for the complete elimination or mitigation of all risks. A certain level of risk will need to be accepted. These accepted risks (residual risks) shall be documented with final review and approval by the GOES-R Series Program Manager.

1.4.3 Policies and Guidelines

- This NOAA GOES-R Series Program RMP will, as a minimum, be: reviewed annually; modified as required after the selection of materials developers, contractors, etc.; and, updated to reflect process changes during the different phases of the program's lifecycle.

- To the extent possible, the GOES-R Series Program will address commonality and related risks with other related programs, utilize lessons learned from historical data, and review and audit segment developer's, materials developer's and other affiliated organization's risk management processes for compatibility with this plan.

- All program personnel (i.e. scientists, engineers, managers and technicians) supporting the GOES-R Series Program are responsible for adhering to risk management policies and guidelines, as documented in this plan. All GOES-R Series Program personnel shall be provided open access to identify risks directly to the program through the process defined in this plan.

- Risks (associated with technical performance, requirements, budgets, schedules, or other issues) are the responsibility of the individual segment/materials developers, affiliated organizations, segment, element, subsystem leads or managers. Each is required to take action to identify, assess and mitigate risks within their area of control and report risks to the GOES-R Series Program on a regular basis.

- Segment developers, materials developers, contractors, and other affiliated organizations shall, as a minimum, provide the GOES-R Series Program with sufficient access and documentation to demonstrate effective implementation of their RM processes and shall periodically report their risks as part of the agreed upon program management procedures. All other RMPs will be subordinate to the GOES-R Series Program RMP, to the extent required to establish consistency and maintain compatibility.

- Joint risk management activities conducted by segment/materials developers or other affiliated organizations working on the GOES-R Series Program shall be planned, coordinated, and conducted in a manner that is consistent with the RM approach established by this plan.

- All changes to the baseline GOES-R Series Program RMP will be made in accordance with GOES-R Series Program Configuration Management procedures. Changes to all other affiliated organization(s) RMPs must be communicated to the GOES-R Series Program in a timely manner to ensure consistency and compatibility with this plan.

- Risk documentation and communication at all levels within the GOES-R Series Program shall be considered open and public in nature. Risk information shall be available for review (through risk lists, risk databases, and other means), but will remain subject to security, proprietary information, company confidential and/or ITAR restrictions similar to those imposed on all other program documentation.

- To maximize the effectiveness of the RM program, GOES-R Series Program team will receive RM training. As a minimum, the GOES-R Series Program is expected to successfully complete the basic RM training. This training may also be made available to other affiliated organizations, at the GOES-R Series PM's discretion.

1.5 Related Documents and Standards

This RMP is intended to complement the overall GOES-R Series program management process. The GOES-R Series Integrated Program Management and Acquisition Plan (IPM/AP) describes the management activities of the overall program. The RMP is subordinate to the GOES-R Series IPM/AP and is considered consistent with the requirements and guidelines of the following documents.

- NOAA Strategic Plan (Draft), 12/02
- GOES-R Program Requirements Document – I (GPRD-I)
- GOES-R Mission Requirements Document (MRD)
- DOC-208-3, Major System Acquisitions
- Concept of Operation for the NOAA's NESDIS (CONOPS), Version 1Definitions
- GOES-R Series Integrated Program Management and Acquisition Plan (IPM/AP)

1.6 Definitions

Accepted Risk	A risk (an unplanned event) that is understood and agreed to by the program, organization partners, sponsors, stakeholders, and customer(s) sufficient to achieve the defined success criteria within the approved level of resources. A risk is accepted when its impact is deemed "acceptable" (does not drive a change to the baseline), and/or no additional resources are expended to mitigate the risk. In other words, it is decided that no further action will be taken to reduce the risk.
Affiliated Organization	Other Government agencies, other NOAA facilities, research institutions, or contractors that provide support (acquisition, design, development, financial resources, facilities, materials, procedures, equipment and personnel) to or are otherwise associated with the GOES-R Series Program or its program segments and materials developers.
Closed Risk	Risk either fully mitigated or otherwise retired.
Expected Value (or Expected Utility)	The product of two numbers, probability and impact (value or amount at stake other than a monetary value, i.e. utility).
Initial Risk List	An initial set of risks identified by GOES-R Series Program. These risks will be identified through brainstorming sessions and interviews conducted by the Risk Management Coordinator with the Program team, and will include preliminary analysis of Program schedules, technical performance, budgets, and resource allocations.
Joint Risks	Risks related to the GOES-R Series Program and segment(s) collectively involving coordinated risk handling/action. These risks include risks crossing all segments and risk crossing multiple segments.

Qualitative Risk Analysis	A subjective assessment of risks to:
	▪ Determine which risk events warrant a response
	▪ Determine the probability and impact of all risks identified in a subjective manner
	  ▪ Determine the probability of each risk occurring based on past experience
	  ▪ Determine the impact (amount at stake, or consequence) of each risk occurring based on past experience

- Determine which risks to analyze more fully using quantification or to skip risk quantification in favor of going directly to risks handling/action planning. (This decision depends on many factors, including the importance of the program and potential affect on the organization performing the mitigation.)
- Document non-critical or non-top risks
- Determine the overall risk ranking for the program

Quantitative Risk Analysis	A numerical analysis of the probability and consequences (amount at stake or impacts) of the highest risks on the program. Risk quantification involves the following activities: ▪ Further investigation into the highest risks on the program ▪ Determination of the type of probability distribution that will be used – e.g., triangular, normal, beta, uniform, or log normal distribution. ▪ Interviewing experts (data elicitation) ▪ Sensitivity analysis – determine which risks have the most impact on the program ▪ Monte Carlo analysis (computer based simulation) ▪ Decision Tree analysis
Residual Risk	The element of a risk remaining after a risk has been mitigated
Risk	The combination of the likelihood that a program will experience an uncertain event and the consequence of the event, were it to occur. Note: Positive-outcome events and/or extremely low probability/impact-outcome events can similarly be considered. Any circumstance or situation that impacts; public safety, program controlled cost; program controlled schedule; or major mission objectives, and for which an acceptable resolution is deemed unlikely without focused management effort.
Risk Action Plan (Risk Mitigation Plan)	A formal plan to determine the action needed to address a risk. In the GOES-R Series Program Risk Management database, each action plan will be entered as a data item.
Risk Categories	Sometimes referred to as sources of risk or common categories of risks experienced by an organization or program. The categories help analyze and identify risks on each program. Some categories of risks are: ▪ Technical risks (e.g., operations or performance) ▪ Program management risks ▪ Organizational risks ▪ External risks (e.g., legal or environmental)
Risk Exposure	The qualitative combination of Likelihood (Probability) and Consequence (Impact) components of a risk using a Risk Rating Matrix to prioritize risk to a program.
Risk Factors/Risk Attributes	The major characteristics of the risk that include: ▪ Probability that a risk will occur or anticipated frequency of risk event (how often) ▪ Range of possible outcomes (what) (impact, severity, or amount at stake) ▪ Anticipated timing or timeframe (when) ▪ Expected Value (EV) (How much money?) or Expected Utility (EU) (What non-monetary value?)
Risk Fallback Plan	A formal plan devised to identify specific action to be taken if the Risk Action Plan (Risk Mitigation Plan) is not effective. In the GOES-R Series Program Risk Management database, each fallback plan will be entered as a data item.
Risk Identification	A risk management activity that determines which uncertain events or conditions might affect the program and documenting their characteristics

Risk Management	A process involving the following six steps: ▪ Risk Management Planning ▪ Risk Identification ▪ Risk Assessment and Analysis (Qualitative and Quantitative) ▪ Risk Handling/Action ▪ Risk Tracking and Control ▪ Risk Documentation and Communication
Risk Management Board	Management board that is the official forum for formal evaluation, deliberation, classification and control of program risks.
Risk Originator	The individual that first identifies and records the risk in the Risk Management database.
Risk Owner	An individual assigned by the Program or Segment Manager through the RMB to implement action/ mitigation plan activities needed to close or accept a specific risk with the authority and resources to action on a pre-approved plan once triggers are reached.
Risk Rating Matrix (Risk Matrix)	A matrix used to qualitatively sort or rate risks so a determination can be made as to which risks will move on through the risk process. Use of this matrix results in a more consistent evaluation of low, medium, or high making the risk rating process more repeatable across the program.
Risk Research	An extension of the Risk Identification in the case where specific research is warranted before completing the risk identification step and deciding between specific risk handling approaches. The risk action plan in the RM database then takes the form of a research plan with a commitment for the research report to be delivered by a specific date with other specific triggers and metrics also required.
Risk Handling/Action Planning	Determining approaches that make the negative risk smaller or eliminate it entirely, as well as finding ways to make opportunities more likely or greater in benefit. This process involves: ▪ Strategies agreed upon in advance by all parties ▪ Primary backup strategies are selected ▪ Risks assigned to individuals, the Risk Owner, to take responsibility ▪ Strategies reviewed over the life of the program for appropriateness and effectiveness ▪ Triggers notifying the Risk Owner to take pre-planned, pre-approved action
Risk Response Strategies	Activities needed to close or accept a specific risk. These strategies also referred to as risk action approaches involve developing options and determining actions to address the risk. This may include changing the planned approach to completing the objectives – e.g., changes to the Work Breakdown Structure (WBS), schedule, or budget. In each case, communication of risks and strategies is necessary as part of the risk handling/action planning. These strategies are documented in the risk action plan and the risk database. The strategies include: ▪ Avoidance – Eliminating the threat by eliminating the cause ▪ Mitigation – Reducing the probability or the consequences of an adverse risk and increase the probability or consequences of an opportunity ▪ Acceptance – Do nothing and say, "If it happens, it happens." Active acceptance may involve the creation of contingency or fallback plans. ▪ Transfer – Make another party responsible for the risk through purchasing of insurance, performance bonds, warranties, guarantees or outsourcing the work.
Risk Tolerance	The amount of risk that is acceptable (tolerance level). For example: "a risk that affects our reputation will not be tolerated", or "a risk of a two week delay is okay, but nothing more."

Risk Triggers	The early warning signs or indirect manifestations (trends) for each risk on a program that indicate action needs to be taken. Risk triggers are part of the risk handling/action plan providing the "go-ahead" for implementing the pre-approved action plan.
Team	A (generally small) formal or informal GOES-R Series Program group, working on a specific task, service, product, or functional discipline. Under GOES-R Series Program Risk Management, risks are assigned to Risk Owners to be worked with support from subject matter expertise and the program team.
Team Lead	The leader of a group or team who is responsible to assign risks to group members and also to verify that new risks submitted to his or her team have been routed correctly. Note: If a given risk appears to pertain to at least two subgroups belonging to a single team higher in the organization, than the risk should be reassigned to the "higher" team after which it becomes the responsibility of that team lead or manager.
Watch Item	Watch item is an issue or concern considered for elevation to a risk. If the issue is not validated as a risk, no immediate action is taken. Instead, a timetable is set up for specific times to re-evaluate the issue, if needed, for a change in status. These "watch points" might be at regular time intervals, or at specific points in the lifecycle, such as at major reviews.

Section 2 Risk Management Philosophy & Integration

2.1 Risk Management Philosophy

The RM process begins with the development of this plan in which the general risk management paradigms are tailored to the GOES-R Series Program; resources are allocated; a support organization and functional responsibilities defined; and a risk management process is established.

As illustrated in Figure 2-1, the following activities are performed in the risk management process:

- Risk Management Planning: The up-front activities necessary to execute a successful risk management program.
- Identifying risks: A continuous effort to identify and document risks as they are found,
- Assessment/Analyzing risks: An estimation of the probability, impact, and timeframe of the risks, and classifying sets of related risks, and prioritization of risks relative to each other,
- Handling/Action planning: A decision about what to do with the risks, which, for important risks, will include pre-authorized action (mitigation and fallback) plans for Risk Owners,
- Tracking and controlling risks: Collecting and reporting status information about risks and their mitigation plans (where appropriate) and taking corrective action as needed.
- Communicating and documenting risks: Continuous at each step of the process to provide support for decision-making and risk traceability.

These risk management activities will be carried out as part of the day-to-day activities of the program and segment as well as during key program and segment management meetings. A summary of the data inputs and outputs in each function of the process is summarized in Table 2-1, Risk Management Data Inputs and Outputs.

Risk Step	Inputs	Output
RM Implementation Planning	Program Constraints and Assumptions, Program Organization, Mission Concept, High-Level Requirements, WBS, Top-Level Schedule, Policy Requirements	Risk Management Plan Risk Organization Risk Criteria
Identification	Individual and Group Concerns, Program Data, Brainstorming Historical Data and Lessons Learned Information	Risk Contexts and Statements Risk List
Assessment/Analysis	Risk Statement and List of Risks	Risk Consequences, Statements, Impacts, Probability, Timeframe, Classifications and Priority Rank; Master Risk List, Identification of Groups of Risks Expected Value
Handling/Action	Outputs of Analysis Step, Program Resources, Goals, and Constraints (Cost and Schedule)	Risk Action Plans, Risk and Mitigation Metrics, Program Schedule and Budget revisions reflecting commitments to risk action plans
Tracking/Control	Action Plans, Metrics, Risk Analysis	Status Reports regarding Risks and Mitigation Plans
	Outputs of Action and Tracking Steps	Program Decisions- Risk specific including Re-Planning, Closure, Contingency, or Descoping
Communication and Documentation	Outputs of all RM Steps, Supporting information and documentation	Risk Management Database reports, status reports, tracking logs, and presentations

Table 2 - 1 Risk Management Data Inputs and Outputs

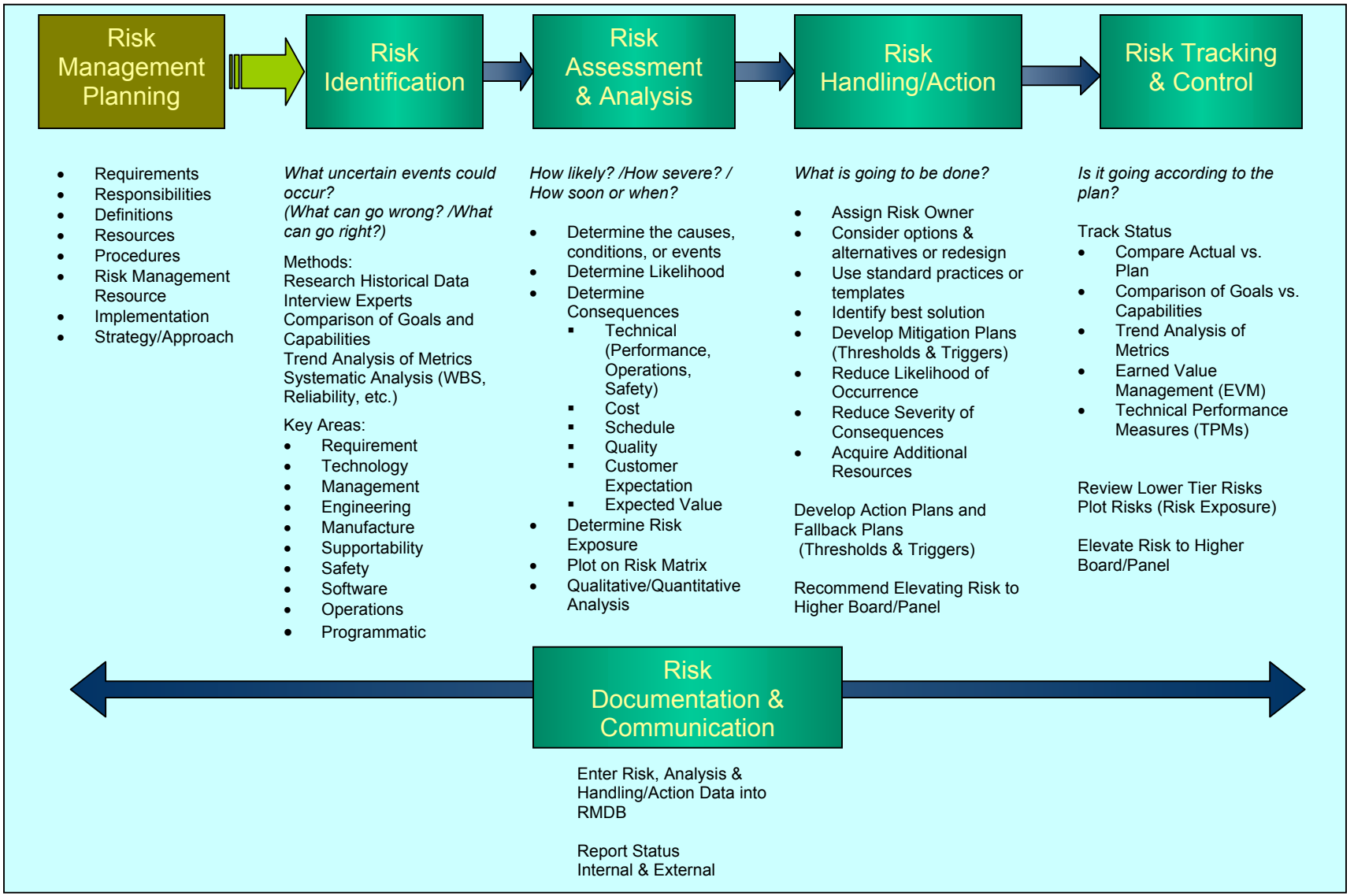


Figure 2 - 1 Risk Management Functions

2.3 Risk Management Integration

The GOES-R Series Program Risk Management philosophy defines a multi-layer approach for risk management that allows cognizant segment organizations, materials developers, teams, groups, and organizations (i.e., Independent Product Teams (IPTs)), to retain authority and control over risks for their areas of responsibility while supporting existing management and decision making processes.

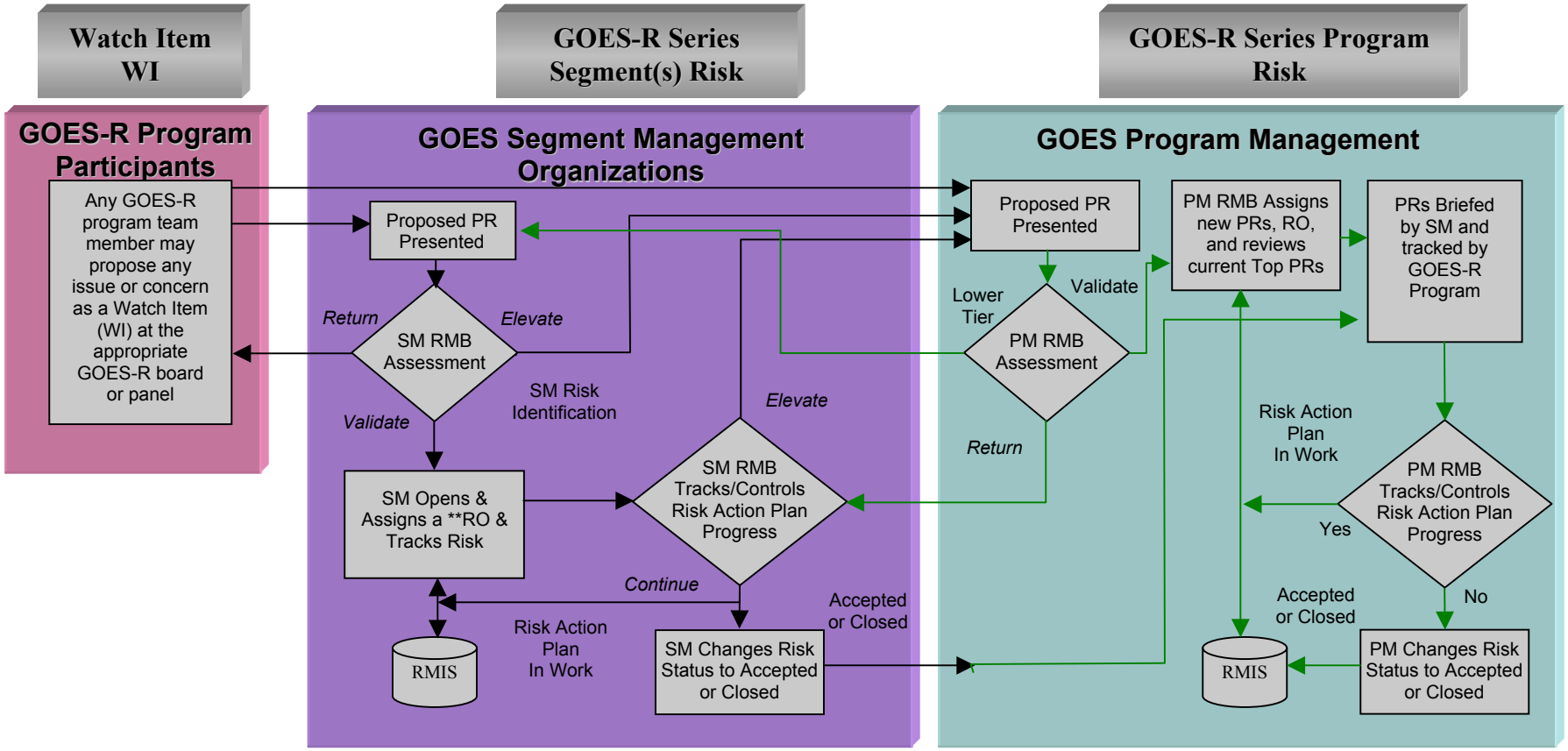
Program, segment, and joint risks will be identified addressing technical, cost, and schedule impacts related to the:

- Successful design, development, fabrication/manufacture, integration, tests, deployment and operations of the GOES-R Series Program;
- Performance and reliability of the GOES-R Series End-to-End System.
- Activities and resources including staff, contractors, and facilities, at NOAA, at other government agencies such as NASA Goddard Space Flight Center, developer organizations (domestic and international), and other foreign or international government or research agencies that may enter into partnership with the NOAA in support of the GOES-R Series Program mission.

Joint risks are risks related to the GOES-R Series Program and segment(s) collectively. Joint risks and proposed mitigations are considered within the purview of GOES-R Series PM and will be tracked within the GOES-R Series Program Risk Management database. Responsibilities and actions to resolve joint risks will be conducted in concert with the respective managing organizations, in accordance with existing agreements and/or contractor requirements.

GOES-R Segment and GOES-R Series Program Figure 2-2 depicts the integrated risk management process flow describing the risk information flow between the Program and Segment Risk Management Boards (RMBs). These risks management process are separated, in part, because: risks are managed differently at different at other levels of an organization, the methods used for identifying the risks may be different; the probability and impact scales used in evaluating the risks may be different; the mitigation options available may be different; and, the risk review and risk handling processes may be different. However, all risks are ranked according to an established set of criteria and provided as inputs to the program risk list.

Program risks must be submitted to the Program-Level Risk Management Board (RMB). Program risks are those risks that significantly impact program objectives affecting public safety, integrity of the hardware and software, or mission success, that pose a threat to key milestones such as launch dates or other key integration dates, or that require substantial Program resources. These risk are designated as Program-level risks by the PM at the RMB. The status of all approved risk actions will be reported to the GOES-R Series PM so that program requirements, plans, budget and schedule can be updated. All risks that have not been avoided or accepted in the initial planning (to include lesser prioritized risk) will be monitored and controlled throughout the program management life cycle of the program. Each of these risks will be assigned a Risk Owner who will be delegated authority to exercise the pre-approved action and fallback plan should a specific trigger be reached.



PRs = Program Risks.

RMB = Risk Management Board.

RMIS = Risk Management Information System (Risk Management Database)

RO = The Risk Owner

SM = Segment Management -The designated GOES-R Panel, Board, or Office responsible for providing oversight and accountability for risk abatement and closure activities.

WI = Watch Item - A GOES-R Program Management or SM concern or issue.

Figure 2 - 2 Integrated Risk Management Process Flow

Section 3 GOES-R Series Program Risk Management Functional Structure and Responsibilities

3.1 Program Risk Management Structure

This section describes the GOES-R Series Program RM functional structure and responsibilities. The GOES-R Series PM has overall technical and programmatic responsibility for RM from initial planning through implementation to disposal. In general, the responsibility of day-to-day RM implementation is delegated to the Risk Management Coordinator, the RMB, Risk Owner(s) as assigned, and effectively to each IPT and individual.

The GOES-R Series Program RMB, the Risk Management Coordinator, and the Risk Owner are functional elements that support the process. The GOES-R Series Program RM is structured around the RMB as depicted in Figure 3-1. Each manager and lead is responsible for assuring that their IPTs, contractors, and other affiliated organizations are full participants in the RM process. The Segment Managers, along with the other managers are responsible for integrating the materials developers' and affiliated organizations' RM processes into the overall GOES-R Series Program process.

As shown in Figure 3-2, responsibilities for risk management are overlapping. The responsibilities are summarized in Table 3-1. More detailed descriptions of roles and responsibilities for selected key personnel are provided in the subsequent paragraphs.

The RM process provides options for reevaluating and updating each previously implemented risk such as consolidating risk sets into single risks, re-writing risk descriptions and contexts (making them more precise or to reflect the most current information) and revising risk analysis information. The GOES-R Series Program RMB, at any time during the process, can request that ad-hoc team be convened to address one or more specific critical risks from end-to-end and across segments, groups, teams, or functional areas. Each risk is assigned a Risk Owner who will be responsible for carrying out the risk response (i.e., "own the risk"). The Risk Owner is then free to take predetermined action when a trigger (early warning) occurs resulting in faster action minimizing cost, time, and other impacts on the program. Using Risk Owners means a substantial decrease in the need for meetings when a problem arises. Risk Owners have the authority and resources to implement a pre-approved plan for action. The RM process also provides options for reevaluating and updating risk handling/actions, planning, tracking, and other activities of the RM process. The primary methods for modifying RM implementation will be through the periodic updates to this plan and through inputs to the GOES-R Series Program RMB.

3.2 Program Management Responsibilities

Within the GOES-R Series Program, there are multiple levels of risk management responsibilities. The GOES-R Series PM retains ultimate responsibility for accepting risk and for allocating resources across the program to eliminate, reduce, or mitigate risks. The high-level strategies of addressing the highest priority (and in many cases most visible) risks will, in general, be the shared responsibilities between the PM and Segment Managers.

The GOES-R Series PM and Segment Managers are responsible for:

- Prioritizing mitigation strategies based on overall risk exposure, constraints, and available resources.
- Authorizing expenditures of resources to eliminate or mitigate risks, at their level of authority.
- Resolving conflicts or disputes among lower tier organizations and teams.
- Communicating risk metrics/measures, significant risks, and status to higher-level management and other NOAA senior management.
- Coordinating the acceptance of risk with NOAA senior level management.
- Setting policy regarding the communication of GOES-R Series Program risks.
- Delegating risk management responsibilities to the lower tier management, when necessary.

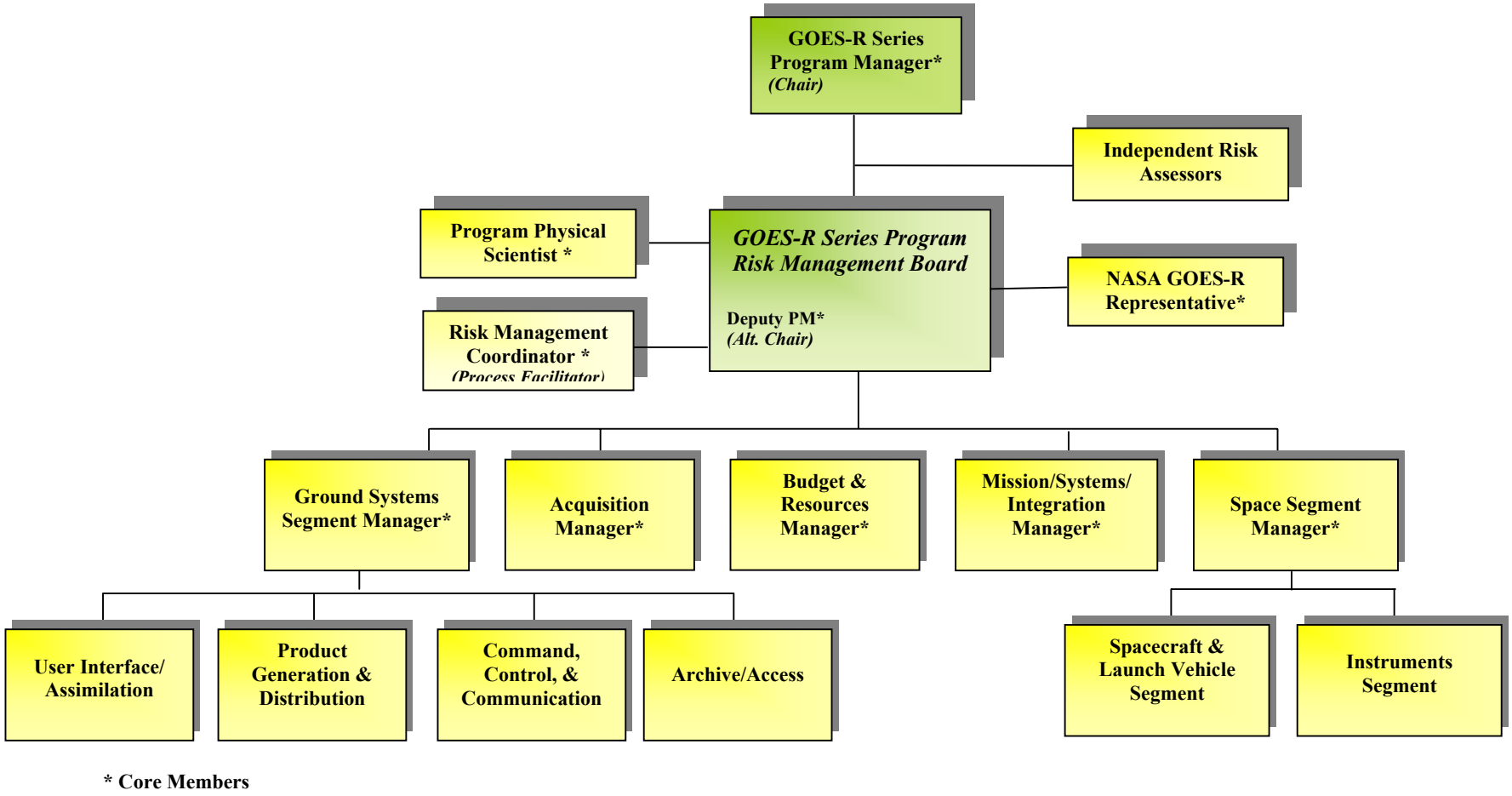


Figure 3 - 1 Risk Management Functional Structure

Figure 3 - 2 Responsibility and Activity Overlap

Who	Responsibilities
Individuals and IPTs	• Identify new risks • Estimate probability, impact, and timeframe • Classify risks • Recommend approach and actions • Track risks and mitigation plans (acquire, compile, and report)
Program or Segment Manager(s)	• Final authority for risk closure and/or risk acceptance • Final review and approval for control decisions (analyze, decide, execute) for program risks • Authorize expenditure of Program or Segment resources for mitigation • Final review and approval for assignments or changes in responsibility for risks and mitigation plans within the Program or Segment (e.g., moving responsibility for a risk from spacecraft to instrument) • Communicate significant risks or changes to senior management.
Risk Management Boards (RMBs)	• Review risk information from all areas and determine validity of the risks (consolidation, reclassification, transfer to action items/non-conformance, etc.) • Reprioritize all risks to determine significant risk for overall program and in each area (software, hardware, etc.) • Accept, revise, or propose additional action plans • Make control decisions (analyze, decide, execute) for risks • Make recommendations for additional trade studies or research. • Make recommendations to Program or Segment Manager(s) regarding expenditure of resources for mitigation • Assign or change responsibility for each risk, mitigation plan, and fallback plan • Communicate significant risks or changes to the Program and Segment Manager(s) • Make recommendations to Program or Segment Manager regarding risk closure and/or acceptance • Compile documentation on all of the significant risks identified and effectiveness of mitigation strategies in reducing and/or eliminating the risks as historical data to be used as lessons learned.
Risk Owner	• Individual assigned by the Program or Segment Manager through the RMB • Develop and implement of all plans and activities needed to close or accept a specific risk. • Communicate handling/action effectiveness or any significant changes to the RMB via the Risk Management Coordinator • Document progress and status of risk mitigation • Make recommendations to RMB regarding risk closure and/or acceptance • Develop and implement action plans • Document effectiveness of mitigation strategies in reducing and/or eliminating the risk assigned as historical data to be used as lessons learned.
Team Leads/Managers and Risk Management Coordinator	• Utilize Historical data and other lessons learned information to identify/mitigate potential risks • Ensure accuracy of probability/impact/timeframe estimates and the classification • Review recommendations on approach and actions • Build action plans (determine approach, define scope and actions) • Report significant risks and issues to the RMB • Collect and report general risk management measures/metrics

Table 3 - 1 Risk Management Responsibilities

3.3 Individuals and Integrated Product Teams (IPTs)

The critical expertise for risk identification, analysis, and action planning is found in the GOES-R Series Program teams, developer teams, and each individual team member working within a specific instrument, discipline, subsystem, or element. Therefore, these teams and individuals are the primary source for identifying potential risks and associated mitigation strategies.

Each Segment/IPT has the flexibility to organize its RM activities as it chooses, including, for example, approaches to risk identification and analysis. However, to ensure standard risk communication among teams and with management, a common report format, risk exposure ranking (likelihood & consequence), adherence to the GOES-R Series Program risk guidelines, and the use of the GOES-R Series Program RM database to document the risks, will be required.

Risks are similar to requirements in that they are hierarchical. At the team level, this hierarchy can be considered to have two levels. The first level contains risks that the team expects to be able to address within the scope of their normal activities, using already allocated resources. These risks may be termed internal team risks and will be formally reported and tracked using the program's risk process (and risk database) allowing for management oversight. The second level contains risks that are not totally under the team's control such as risks related to interfaces or functional/shared responsibility with other teams. The team cannot fully control the risk or mitigation activity for such a risk. Because these risks cross team responsibilities, they require the coordination and resources of one or more higher levels of the program. These risks, or joint risks, need to be elevated to higher level RMB for additional analysis and mitigation.

3.4 GOES-R Series Program Risk Management Board (RMB)

The RMB is the official forum for formal evaluation, deliberation, classification and control for all program risks. The RMB consists of the core members that include the GOES-R Series PM (Chair), GOES-R Series Deputy Program Manager (Alternate Chair), Segment Managers (Ground Systems & Space), Acquisition Manager, Budget and Resources Manager, Mission Systems/Integration Manager, Physical Scientist, NASA GOES-R Representative, and Risk Management Coordinator, and functional area specialist, as needed. As a minimum, at least five core members must be present to have a RMB quorum. As the GOES-R Series Program evolves, the membership of the board may be augmented with other individuals or be otherwise changed. The final authority for the membership of the RMB resides with the GOES-R Series PM. It is responsible for:

- Reviewing any risk issues that have arisen since the last RMB meeting.
- Validating and prioritizing risks from the current set of risks, reviewing risk descriptions and risk analyses provided by individuals or teams.
- Reviewing and adjusting risk action planning (mitigation plans, mitigation time frames, etc.) proposed by teams, for the same set of risks, and reassigning risks when necessary.
- Performing the risk control function for the program as a whole (given risk tracking information, mitigation or fallback plans, descope plans, etc., for individual risks).
- Initiating trade studies or other research regarding particular risks, as needed.
- Providing the PM with recommendations on how to allocate available resources across the current set of risks supporting a balanced risk reduction approach.
- Assigning a Risk Owner for each risk identified
- Assigning and coordinating resources to implement and maintain the GOES-R Series Program tailored RM process.

Additionally, the RMB shall reconcile risks that have been proposed by segments, teams, or individuals but which are (or appear to be) mutually incompatible. The RMB shall also consolidate duplicated risks and resolve incompatibilities or conflicts in a balanced and comprehensive manner. Resources shall be applied to reduce each risk commensurate with the risk exposure.

Working group meetings provide another ad hoc forum in addition to the RMB for risk management communication. The Risk Management Coordinator convenes an informal working group on an as needed basis. The working group membership is open to any member of the program team interested in the details of the RM

process. In particular, Risk Managers for any segment, materials developer, contractor, or subcontractor are invited to participate. The scope of discussion for these meetings includes:

- Requirements for, and choice of, any tools used in the process.
- Effectiveness of the current risk management process, at the detailed level, and possible changes and/or improvements.
- Risk data input templates and risk data reporting formats.
- New developments and policy statements in the risk management field.
- Rating scales for risk probability and risk impact.
- Details of any current, high-level risks that are critical to the program.
- Risk identification, information development and documentation with teams or other groups to clarify terminology, point of view, operating constraints, and risk mitigation goals to facilitate risk communication across the program.

3.5 Risk Management Coordinator

A Risk Management Coordinator is assigned functional responsibility for supporting and facilitating the RM process for the GOES-R Series Program and is responsible for:

- Assisting in the development, implementation, and maintenance of the GOES-R Series Program Risk Management Plan.
- Communicating the objectives of RM and implementation details to all program organizations and team members.
- Serving as the facilitator to the RMB, by scheduling meetings, preparing the agenda, identifying specific risks to be presented, and tracking action items as assigned by the board.
- Ensuring that the RM database and other risk related documents are maintained.
- Coordinating the GOES-R Series Program risk process with RM, resource assessment, and other programmatic, technical and functional disciplines.
- Providing informal and formal risk management training as required.

3.6 Mission/Systems/Integration Manager

The Mission/ Systems/Integration Manager is responsible for:

- Maintaining the configured requirements for the program.
- Performing trade studies of alternate technologies and their associated performance parameters in support of the risk prioritization and mitigation strategies.
- Providing engineers to assist in the review, interpretation and detailed planning for risk handling/action.
- Tracking Key Performance Parameter (KPPs), reserves of mass, power, volume, and other critical parameters.
- Coordinating and integrating the requirements, design and implementation, including integration and test, for all levels of the program particularly those that cut across team and/or functional boundaries.

3.7 Risk Owner

The Risk Owner is an individual who has been assigned responsibility for:

- Implementing all plans and activities (preauthorized mitigation plans & fallback plans) needed to close or accept a specific risk.
- Communicating handling/action effectiveness or any significant changes to the RMB via the Risk Management Coordinator
- Documenting progress and status of risk mitigation
- Making recommendations to RMB regarding risk closure and/or acceptance

- At the completion of the risk handling/action, documenting the overall effectiveness of mitigation strategies in reducing and/or eliminating the risk assigned as historical data to be used as lessons learned.

3.8 Program Physical Scientist

The GOES-R Series Program Physical Scientist, in addition to being a member of the RMB, is considered a representative of science, stakeholder, and customer community and is responsible for ensuring that risks related to these areas are managed and communicated in an appropriate manner. The GOES-R Series Program stakeholders and customers, as represented by the GOES-R Series Program Physical Scientist and the GOES-R Series Operational Requirements Working Group (GORWG) are considered significant participants in the GOES-R Series Program RM process.

3.9 Materials Developers and Affiliated Organizations

Material developers and affiliated organizations shall be fully integrated into the GOES-R Series Program RM process. The precise method of integrating the organizations into the GOES-R Series Program process will be developed over time. Some elements of the approach are summarized as follows. Developers and affiliated organizations are responsible for:

- Implementing a RM process and participating in the GOES-R Series Program RM process.
- Implementing a rigorous programmatic and systems engineering process (resource management, cost and budget tracking, critical path/schedule tracking, configuration management, systems assurance, process control, requirements definition, interface control, integration and testing, etc.).
- Using a common rating scale and compatible tools to coordinate these activities to ensure the timely communication and documentation of risk information to the GOES-R Series Program.
- Identifying risks with technical, safety, programmatic, cost, or schedule impacts.
- Implementing mitigations and allocating resources proportional to the risk exposure (i.e., highest risks get the most resources for mitigation) with the established constraints of cost, schedule, and technical reserves (mass, power, volume, etc.).
- Reporting on overall risk assessments and other risk management activities at monthly reviews, and other venues.

The scope of risks addressed by the GOES-R Series Program will include joint risks related to the use of dedicated facilities and resources other than those operated by NOAA. The exact process for reviewing such joint risks and deriving appropriate joint risk action will be documented in this plan after the respective agreements or contracts are established. These negotiations will also be done in accordance with any pre-existing agreements. This shared process will be greatly facilitated by aligning the RM processes in the various organizations including the use of common rating scales, common terminology, and frequent communication, informal as well as formal.

3.10 Independent Risk Assessor

An independent risk assessor is a person who is not in the management chain or directly involved in program being assessed. Use of Independent Risk Assessors is an effective technique to ensure that all risk areas are identified and that the consequence and likelihood/probability are properly understood. The Independent Risk Assessor can be used at different program levels and at different times in the program lifecycle. The Program Manager will approve the use of Independent Assessors, as needed.

3.11 NASA GOES-R Representative

Inter-agency agreements between NOAA and NASA have established a cooperative relationship and shared responsibilities involving technical support, feasibility and concept studies, space segment procurement, spacecraft/instrument design and development, and performance verification (pre-launch verifications, launch and on-orbit). The NASA GOES-R Representative serves as a member of the GOES-R Series Program RMB for communicating risks and coordinating the RM process ensuring continued and effective inter-agency cooperation.

3.12 NOAA GOES-R Series Acquisition Manager

The Acquisition Manager is responsible for:

- Participating in the review, interpretation and detailed planning for risk handling/action related to management & acquisition strategies addressing integration and testing, integrated logistics, training, reliability and maintainability, support equipment, facilities and schedules.
- Tracking events and activities to meet key objectives evaluated against criteria established for Key Decision Points (KDPs) in accordance with the GOES-R Series IMP/AP.
- Coordinating with the Risk Management Coordinator in evaluating, documenting, and communicating the overall program risk status for KDPs and program acquisition milestones by comparing implementation status to baseline cost, schedule, and technical performance.
- Consolidating results of the DRR phases for the program including requirements, WBS, contractual deliverables, and development paths for all levels of the program particularly those that cut across segments to ensure the effectiveness of acquisition strategies in support of the program's overall risk handling/action approaches.
- Serves as the NOAA GOES-R Series Representative on the NASA GOES-R Risk Management Board and coordinates with the NASA GOES-R Series Representative inter-agency risk management activities.

3.13 Budget & Resources Manager

The Budget & Resources Manager is responsible for:

- Maintaining the resources, budget, and integrated network schedule for the program.
- Tracking the variances between baseline and actual resource allocation, cost, and milestones/critical path.
- Supports studies of alternative approaches in support of the risk prioritization and mitigation strategies.
- Providing analysts to assist in the review, interpretation and detailed planning for risk handling/action.
- Coordinating with the PM, Acquisition Manager, and Risk Management Coordinator in evaluating, documenting, and communicating the overall program risk status for KDPs and program acquisition milestones by comparing implementation status to baseline cost, schedule, and technical performance.
- Allocating budget for risk management.

Section 4 Risk Management Process Details

4.1 Process Flow

This section provides the details on the RM process. A summary of the process flow and the interrelationship with the RM database, or Risk Management Information System (RMIS), are illustrated in Figure 4-1. The GOES-R Series RM will incorporate a web-based RMIS to compile and track risk data gathered from a variety of sources. All program members are encouraged to use the RMIS to track risks for their level, segment, or system.

The GOES-R Series program, segment organizations, contractors and other affiliated organizations shall identify the risks in their respective areas and implement mitigation strategies (corrective actions, action plans, mitigation plans, fall-back plans, etc.) to control these risks. Periodically the risks for each of these organizations shall be reported to the GOES-R Series PM, combined with other identified risks as applicable, and further prioritized to generate the top risks for the overall GOES-R Series Program. Only a selected number of risks for the overall GOES-R Series Program shall have additional resources expended for mitigation. The remaining risks shall be monitored and managed within established program constraints. The status of all identified risks, however, will continue to be tracked with appropriate re-evaluation initiated if required.

4.2 Risk Identification

The risk identification process is designed to identify potential issues or concerns before they become problems and to document and communicate this information throughout the program. Table 4-1 summarizes the risk identification process.

Step	Action
1	New risk is identified.
2	Statement of risk is written for new risk in the proper format (condition, context, and consequence).
3	Additional information regarding the new risk is captured in the context.
4	Risk statement and context of the new risk are recorded on Risk Information Sheet (RIS).
5	Risk statement and context of the new risk are entered in the risk database.
6	New risk is automatically assigned a unique identifier by the risk database.
7	Risk Management Coordinator and RMB review risks entered into the database monthly.

Table 4 - 1 Risk Identification

Risk identification is a continuous process with new risks added and existing risks updated as the program moves through each phase of the life cycle. In some cases additional identification actions, or risk research, may be taken to further investigate risks. Risk Research provides additional information or understanding before further action is taken.

In the initial phases (End-to-End Systems Architecture Definition and DRR), a comprehensive list of risks shall be identified using techniques such as brainstorming, interviews, and taxonomy based risk surveys. All identified risks will be submitted to RMB for validation (determining if it is a risk) and evaluation. The categories (sources) of risk are: technical risk, contract risk, schedule risk, budget risk, safety/environmental risk, and sustainability risk. Other categories will be added as required. Risk identification will involve the review of historical documentation from past GOES acquisition efforts (such as program background information, past lessons learned, program charter, scope statement, teams, the Work Breakdown Structure (WBS) the network diagram, cost and time estimates, staffing plan, and acquisition planning) to assist in identifying common sources of technical risks (e.g., operations or performance), program management risks, organizational risks, and external risks (e.g., legal or environmental).

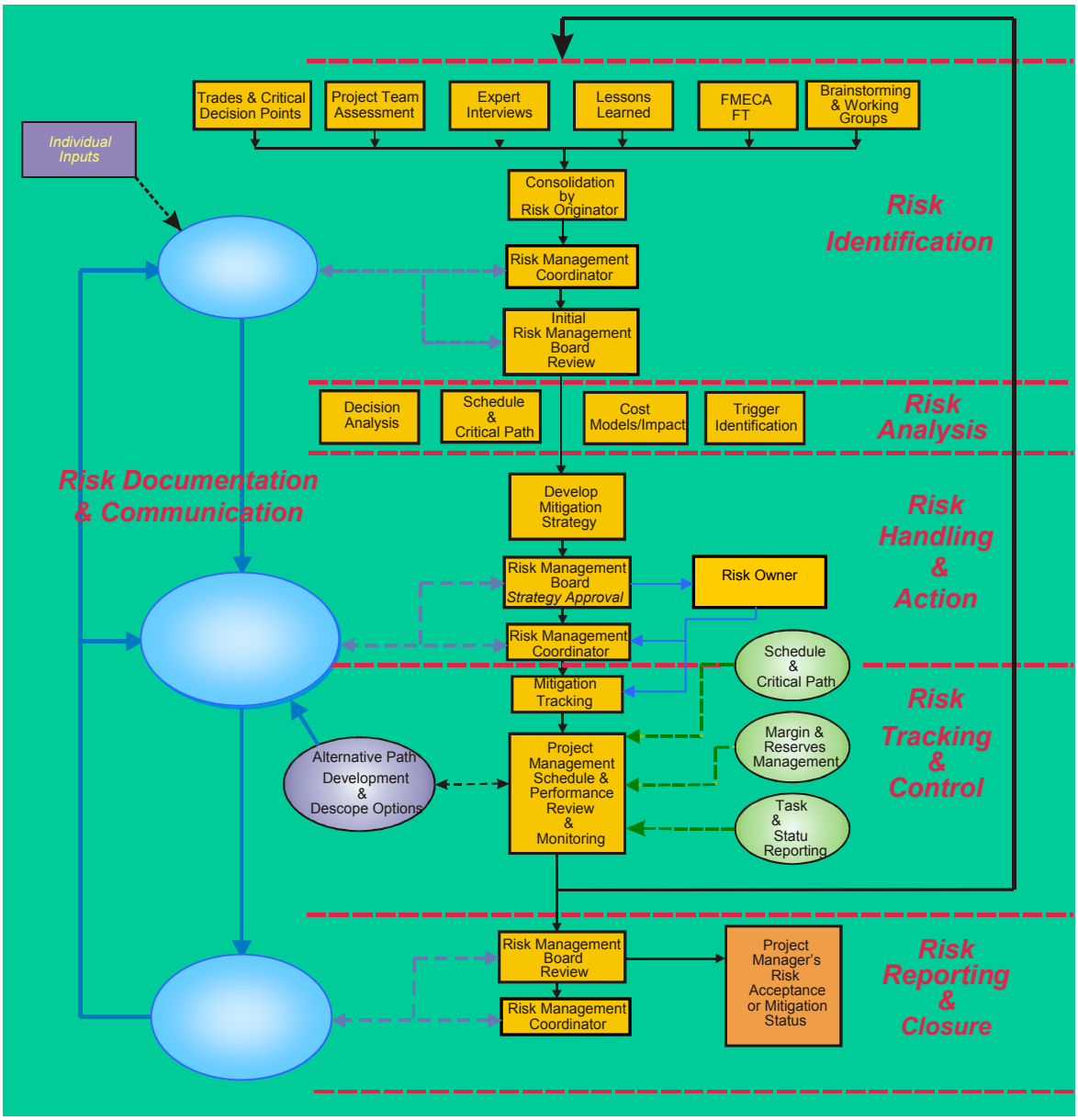


Figure 4 - 1 Risk Management Process Flow

The risk list shall be reviewed and updated periodically at major milestones. These risks will be identified from inputs to the Risk Management Information System (RMIS), as part of meetings routinely held by the GOES-R Series Program and as needed, through brainstorming sessions and interviews conducted by the Risk Management Coordinator with GOES-R Series Program team. These initial issues and concerns, identified as Watch Items (WIs) will be more fully developed before being validated as risks and incorporated into the formal GOES-R Series Program Risk List. As a minimum, a period of five working days following the submission of a new risk information/risks will be reserved for the Risk Management Coordinator, the Risk Originator, and the Risk Owner (if already identified) to review wording, to determine applicability, and to ensure accuracy of the information.

Any potential new risks identified during any program-related meeting shall be added to the RMIS within one week of the meeting with notification provided to the Risk Management Coordinator. It is the responsibility of the meeting leader to make sure that this is accomplished (e.g., assigning a formal action to develop the subject risk).

Any individual, team, or group can identify and submit risk information to the RMB for evaluation. All risk information/risk submittals (whether accepted as valid risks or otherwise dispositioned) shall be documented and retained as part of the official program records.

All new risk information and WIs will be reported to the RMB by the Risk Management Coordinator at the next scheduled RMB meeting. Action to be taken by the RMB for newly identified risks and WIs will include validating new risks, rejecting items not considered valid risks, requiring additional research to more fully develop a WI, and assigning a Risk Owner. Those items requiring additional research will be retained as WIs with the status tracked on the Watch List. Those issues, concerns or problems deemed not truly risks will be rejected as risks with rejection rationale documented in the RMIS, and placed under other reporting and tracking functions as needed (problems and corrective actions, program action items, etc). Validated risks will be marked as "(P)ending" and will continue to be tracked as WIs on the Watch List until a Risk Owner is identified. At that time the validated risk will be assigned a Risk Identification number with status tracked on the Risk List. The RMB will monitor all WI attributes for early warnings of critical changes in impact, probability, time frame or other aspects. The warnings are defined in terms of "triggers that, if they occur, indicate that action is warranted.

The RMB will monitor all WI attributes for early warnings of critical changes in impact, probability, time frame or other aspects. The warnings are defined in terms of "triggers" that, if they occur, indicate that action is warranted.

4.3 Risk Assessment & Analysis

Risk assessment and analysis is used to ascertain as accurately as possible the validity of an identified risk, the likelihood of that risk, the magnitude of the consequence of such an event, and timing for mitigating the risk(s). The following steps are used to analyze risks. Table 4-2 summarized the risk assessment & analysis process.

Step	Action
1	Evaluate to determine if there is a valid risk related to issue, concern, or problem identified. A risk is deemed valid if it truly represents a credible condition with some level of uncertainty having an impact on the program.
2	Risk attributes (impact, probability, timeframe, and Expected Value) are evaluated using qualitative assessment
3	Risk attributes are entered into the risk database.
4	Risk attributes are reviewed and corrected periodically by the Risk Management Coordinator and the RMB.
5	Risks are validated and prioritized in their respective areas by the GOES-R Series PM, Segment Manager(s), and the RMB.
6	Top significant risks are further evaluated using quantitative analysis, as needed

Table 4 - 2 Analyzing and Classifying Risks

Initial Classification. An initial classification of risks shall include organizational levels (NOAA, spacecraft segment, ground located - C3, launch vehicle, etc.), and mission consequence (safety, performance, or program execution) with subcategories of impact (technical, cost, and schedule). Risk attributes of likelihood, consequence, and timeframe are initially estimated by the Risk Originator and entered at the same time the risk is identified and documented. The Risk Management Coordinator will work with the Risk Originator to further develop the risk and determine attributes of the risks.

Validation & Elevation. In each successive level of review, the RMB evaluates the validity of all risks submitted. A risk is deemed valid if it truly represents a credible condition that includes a level of uncertainty with a consequence to the program. A risk may be rejected if it is determined that the issue is something other than a risk (problem or failure), has no merit, or has no impact to the program. Similarly, elevated risks may be returned for resolution at the "lower level".

A risk may be elevated to the attention of higher level management for three reasons: a) the risk exposure is high (red risk); b) the risk spans more than one segment, product area, or discipline, and must therefore be addressed at the next higher level in the organization; or, c) resources and/or authority beyond those available in the original area are required to address the risk.

Risk Assessment. Risk may be assessed either qualitatively or quantitatively. To reduce the subjective factor in making such assessments, the GOES-R Series Program risk management process utilizes rating scales for each of these measures defined in advance – with each of five impact, likelihood, and timeframe levels described in Tables 4-3, 4-4, and 4-5. The impact of a risk event can be to cost, schedule and/or technical performance simultaneously. For any risk, it is the impact with the most severe rating that is used to determine the risk exposure. The 5-Level method shall be used for evaluating attributes. Safety related impacts are not provided since these are addressed in detailed in the appropriate system safety, environmental, and occupational health and safety documentation.

Rank	Consequence (Impact)	Description
5	**Very High**	Cost – Greater than 8% increase over allocated Program or Segment/Subsegment funding and/or exceeds available reserves. Schedule – Any slip in the critical path or any element on the critical path Any slip that affects the award of the follow-on phase Any slip that affects the launch date or delays scheduling to other segments Technical– Key Performance Parameter (KPP) and/or other mission objectives cannot be met. Major new technology development is required
4	**High**	Cost - ≥ 5% ≤ 8% increase over allocated Program or Segment/Sub segment level funding, and/or threatens to reduce reserves below prudent levels. Schedule – Any slip in non-critical path elements of ≥ 3 months ≤ 4 months Technical – Significant impact to meeting KPPs and/or other mission objectives. Moderate new technology development is required.
3	**Moderate**	Cost - ≥ 2% but ≤ 5% increase over allocated Program or Segment/Sub segment level funding, and can be handled within available reserves. Schedule - Any slip in non-critical path elements of ≥ 2 months ≤ 3 months Technical – Moderate impact to meeting KPPs and/or other mission objectives. May require some new technology development.
2	**Low**	Cost - ≥ 1% but ≤ 2% increase over allocated Program or Segment/Subsegment funding, and can be handled within available reserves. Schedule - Any slip in non-critical path elements of ≥ 1month ≤ 2 month Technical– Minor impact to meeting KPPs and/or other mission objectives. No new technology development required. May require minor modifications to existing technologies.
1	**Very Low**	Cost – < 1% increase over allocated Program or Segment/Sub segment funding, and can be handled within available reserves. Schedule – Minimal or no slip in non-critical path elements. No impact to schedule reserve Technical– No impact to meeting KPPs and/or other mission objectives. No technology development or modifications required.

Table 4 - 3 Risk Impacts

Rank	Likelihood (Probability	Description
5	Very High	80-100%
4	High	60-80%
3	Moderate	40-60%
2	Low	20-40%
1	Very Low	0-20%

Table 4 - 4 Risk Probability

Rank	Timeframe	Description
5	Imminent	Mitigation action to start immediately, within 1 month
4	Near Term	Mitigation action to start in 1 to 2 months
3	Mid Term	Mitigation action to start in 2 to 4 months
2	Far Term	Mitigation action to start in 4 to 6 months
1	Very Long Term	Mitigation action to start in 6 and beyond

Table 4 - 5 Risk Timeframe

Qualitative Risk Assessment. The Risk Matrix shown in Figure 4-2 allows a qualitative measurement of the likelihood and consequence of a risk to be made. Using this approach the GOES-R Series Program ranks risks and provides relative "values" of the likelihood of occurrence and potential consequence of each risk. After the probability and the impact of the risk are separately analyzed, these two factors are combined to arrive at a measure of the risk exposure using the Risk Assessment Classification (RAC). A risk exposure shall be determined for each risk. The intersection of the probability rating with the impact rating on the risk matrix will be used to derive this risk exposure. The purpose of the risk exposure is to allow for a common classification of High, Medium, or Low (Red, Yellow, or Green) for all risks regardless of source, type, or consequence.

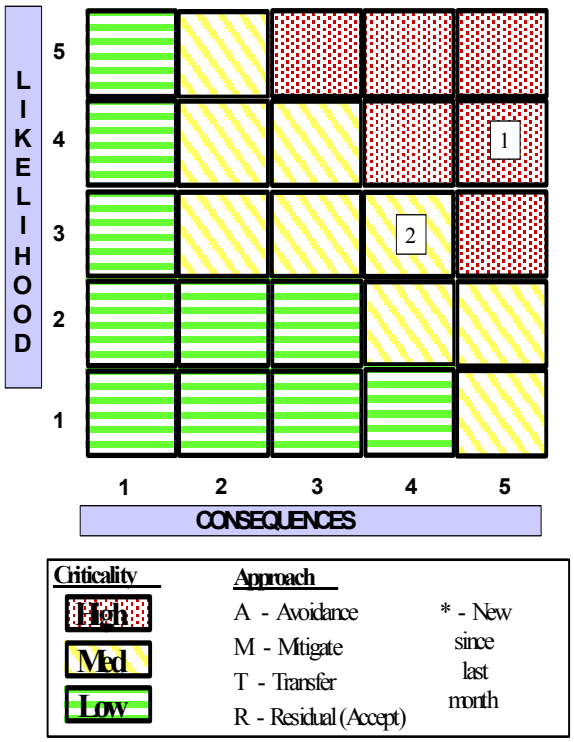


Figure 4 - 2 Risk Matrix

For each risk identified and validated by a RMB, an individual shall be assigned responsibility as the Risk Owner. A risk action plan shall be developed documenting the activities, dates, deadlines, and risk triggers. Expected Values (EV) for the risk occurring shall be determined qualitatively and included in the risk documentation. Table 4 - 6 provides a sample Risk List, based on a WBS, that integrates technical, schedule, and cost risk with cost impact assessed using EV. EV is used when considering cost as the measure of worth. For decisions where "value" is multi-dimensional, a multi-criteria decision making (MCDM) approach may be used. Usually these arise because there are multiple objectives being evaluated or the objectives are not readily converted into dollar values ($). For example, program decisions are generally related to technical performance, cost, and time. The use of the MCDM approach provides a means for understanding and assessing tradeoffs such as: "spend an additional $1 million to complete a program on time" or "complete the program on time and within budget, but with reduced technical performance".

Risk Id	Area	Technical	Schedule	Cost	Expected Risk Impact ($100K)
1	**Technical Performance**	High	Medium	High	3.5
2	**Instrument Development**	High	High	Medium	3.0
3	**Data System Reliability**	High	High	Medium	2.7
4	**Antenna Development**	Medium	Medium	Low	2.0
5	**COTS Procurement**	Low	Low	Medium	0.5

Table 4 - 6 Sample Risk List

Quantitative Analysis. In general, qualitative methods will be considered adequate for making risk management decisions. However, quantitative methods will be used when more precise analysis and understanding of the risk or allocation of resources for risk reduction is needed based on a prioritized list. When warranted, the RMB may request that comprehensive quantitative analyses be conducted to determine risks attributes. The RMB will need to decide whether the risk identification and classification determined using qualitative methods is adequate, or whether the increased precision of quantitative analyses (such as a more detailed reliability analyses, Monte Carlo modeling, etc.) or testing (test-to-failure, life-testing, etc.) is needed. In making this determination, the RMB will need to balance the (relatively) higher cost of risk analysis against the value of the additional insight. The allocation of additional resources for analysis of some risks may limit the availability of resources for mitigating other risks.

4.4 Risk Handling/Action

Risk handling/action takes the input from the risk analysis function and formulates action plans to address them. The risk must first be assigned to an individual, Risk Owner, with the ability and knowledge to address the risk. As newly identified risks are brought to RMB's attention through meetings, database reports or other communication, the appropriate action to handle the risk needs to be determined. Table 4-7 identifies the steps in the risk handling/action planning process.

A number of possible actions can be taken. A given action shall include trigger points at which decisions are pre-planned. These decision points are established in advance to address such things as intermediate risk reduction level or the initiation fallback plan. One of the following actions will be implemented for each risk identified:

- Risk Avoidance: This strategy involves a change in the concept, requirements, specifications and/or practices that eliminate the risk. Simply stated, it eliminates the sources of the risk.
- Risk Mitigation/Risk Control: These two terms refer to taking action to reduce the risk exposure, by reducing either the probability of occurrence, the impact, or both.

- Risk Transfer: The action of shifting risk from one party to another. An example includes purchasing insurance coverage to offset the risk of a launch vehicle failure. All proposed risk transference shall be reviewed and approved by the PM.
- Risk Acceptance: The consequences of a risk, if it were to occur, are accepted; however, no further resources are allocated to risk mitigation. Risk assumption is a conscious decision to accept the associated level of risk, without engaging in any special efforts to control it. A general cost or schedule reserve may be set aside to deal with any problems that may occur due to risks that have been accepted. All risks that have been accepted (not completely eliminated) are considered residual risks.

Step	Action
1	Risk Owner assigned responsibility for risk(s) by the PM.
2	Risk Owner responsible for a risk determines approach to be taken by writing an action plan. Possible actions: avoidance, mitigation/control, transfer, or acceptance.
3	An action plan shall be prepared with triggers identified and anticipated intermediate risk mitigation levels identified.
4	A fallback plan shall also be created with triggers identified anticipated intermediate risk mitigation levels identified.
5	Expected Values (EV) or Expected Utilities (EU) for the risk occurring, action planning, and fallback planning, if applicable, shall be quantitatively determined, revised and included in the risk documentation
6	All action plans and fallback plans are reviewed and resources allocated by the PM.

Table 4 - 7 Risk Handling/Action Planning Steps

The GOES-R Series Program has established the following risk mitigation precedence:

- avoidance or mitigation/control of all safety risks,
- avoidance or mitigation/control of significant performance risk with consideration given to risk acceptance or risk transfer.
- avoidance, acceptance, transfer, and mitigation/control of programmatic risks balanced against the consequence to safety and performance.

The PM and Segment Managers shall ensure that resources for mitigating each of the risks is appropriately allocated. Responsibility for a risk means that the assigned Risk Owner is responsible for the status and mitigation of the risk. The Risk Owner is allowed to take predetermined action when triggers are reached resulting in quicker action with a decrease in the need for meetings when a problem arises. Risk Owners have the authority and resources to implement a prearranged and pre-approved plan for action.

4.5 Tracking and Controlling Risks

Risk tracking and monitoring is the collection of status data for risks with currently implemented action plans. The data is collected for general progress, but also specifically for the metrics identified in the risk handling/action planning step. The responsible Risk Owner supported by subject matter experts and other team members has the responsibility for specifying such metrics, with review by the GOES-R Series Program RMB. Table 4-8 identifies the steps in the risk handling/action planning process.

The Risk Owner for a risk in the top set of risks shall provide routine status reports to the PM during program meetings scheduled on a quarterly basis. The status for each significant program risk shall be reported each week at the appropriate management meetings. Status on all risks and WI shall also be reported periodically. On a monthly basis, Risk Owners assigned responsibilities for risks shall update the status of risks. Re-planning, Accepting or Closing a risk shall require review, and approval by the RMB. Re-planning shall require modification and resubmission of the RIS. Invoking a fallback plan shall require a formal notification by the Risk Owner to the RMB. Accepting or Closing a risk shall require review and approval by the GOES-R Series Program RMB with final approval from the PM.

The RMB has the overall responsibility for risk control by reviewing current risk mitigation status, reviewing the current allocation of resources to risk activities, and considering whether to recommend changes to risk handling/action strategy or allocation. On matters related to resource allocation (assigning personnel, providing

funding, or providing other resource such as facilities or equipment) the RMB is used by the PM to advise and recommend. The PM has the final decision authority and controls the allocation of all resources.

Step	Action
1	Risk Owner tracks risk attributes, triggers, and other related data.
2	Risk Owner implements the approach (avoidance, control/mitigation, transfer, or accept) determined by the RMB to address the risk, exercising the pre-approved Handling/Action Plan when specific trigger is reached using pre-authorized resources.
3	Risk Owner tracks progress, risk attributes and triggers and reports risk mitigation status to RMB identifying intermediate risk mitigation levels and availability of resources as appropriate.
4	If necessary, Risk Owner implements pre-approved Fallback Plan when a specific trigger is reached using pre-authorized resources
5	Risk Owner tracks progress, risk attributes and triggers and reports risk mitigation status to RMB identifying intermediate risk mitigation levels and availability of resources as appropriate.
6	Risk Owner completes action and provides recommendations for risk disposition to RMB & PM (accept, close, re-evaluate, continue mitigation, etc.).
7	Risk Owner provides Risk Management Coordinator with lessons learned.
8	RMB, Risk Management Coordinator, and Risk Owner continue to track residual risk (accepted risk) for changes in attributes.

Table 4 - 8 Risk Tracking and Control Steps

4.6 Risk Management Documenting & Communicating Risks

Documenting and communicating risks on the program provides personnel with an understanding of the risk handling/action strategies, risk mitigation alternatives, and overall risk status. Successful risk documentation and communication raises the level of understanding of relevant issues and actions. RM documentation and communication have the following characteristics:

- Free flow of information between individuals, groups, segments, and management.
- Inclusion of formal, informal, and impromptu communications.
- Value of individual contributions.

Risk Management is integrated into all GOES-R Series program management and technical meetings, communication, and documentation. The management of risk is not considered to be separate from other GOES-R Series program management activities. As risk information becomes available, the PM and RMB will conduct additional reviews to ascertain if new risks exist. Risk documentation and communication at all levels within the GOES-R Series Program shall be considered open and public in nature. Risk information shall be available for review (through risk lists, risk databases, and other means), but will remain subject to security, proprietary information, company confidential and/or ITAR restrictions similar to that imposed on all other program documentation and communication.

4.6.1 Risk Management Information System (RMIS)

The most direct means for communicating and documenting risks is through the GOES-R Series Program RM database. Other methods (verbal, electronic mail, written, etc.) for communicating risks should be directed to the Risk Management Coordinator for action. The GOES-R Series Program will use the Program Risk Information Management eXchange (PRIMX) as its RMIS. The system will contain all of the information necessary to satisfy the program risk documentation and reporting requirements. The RMIS stores and allows retrieval of risk-related data. It provides data for creating reports and serves as the repository for all current and historical information related to risk. Additional details on the RMIS are provided in Appendix A.

Data are entered into the RMIS using the Risk Information Sheet (RIS). The RIS gives members of the program team, both Government and contractors, a standard format for reporting risk-related information. The RIS should be used when any potential risk is identified. When first entered into the database, all potential risks are designated as

Watch Items (WI). After risk validation, a Risk Identification number is assigned with updates made as information becomes available as the assessment, handling/action, and tracking/control functions are executed.

All risk information shall be documented in the risk database. The risk database is accessible by all program personnel for identifying new risks. The responsible person (Risk Owner) must document lessons learned before closing the risk. Those lessons learned shall be reviewed for concurrence by the PM before being entering into the historical documentation archive.

4.6.2 Risk Reporting

The Risk Management Coordinator will use data from the RMIS to create reports for senior management and retrieve data for day-to-day management of the program. The risk management database produces a set of standard reports for periodic reporting and has the ability to create ad hoc reports in response to special queries. If IPTs or functional managers need additional reports, they should work with the Risk Management Coordinator to create them. Access to the reporting generation features will be controlled. However, any member of the team may obtain a password to gain access to the risk information contained in the database. Figure 4-2 provides the example risk-reporting format.

Risk Summary Report

Example

Rank	Risk ID	Risk Title (Detailed Description)	Approach & Plan	Status
1 **Criticality** H	GOES-02 **Planned Closure** 02/02/06	**Thermal Vacuum/Acoustic Test**	**Mitigate**	**Intermediate** M 11/02/04 L 12/22/05
2 **Criticality** H	GOES-06 **Planned Closure** 04/03/05	**On-Orbit Propellant Transfer**	**Mitigate**	**Intermediate** M 11/02/04 L 12/22/05

Figure 4 - 3 Risk Reporting Example

Section 5 Resources and Schedule of Risk Management Milestones

Resources for the management of risks are divided into two categories:

- Overhead costs associated with the risk management process: as a guideline, these resources should not exceed 0.05% of the program budget.
- Mitigation plan costs: resources associated with mitigation plans, specifically those with risk handling/action plans.

Budget allocation for mitigation plan development and execution is, as a guideline, initially set at 1% of the program budget. Contingency funding will be managed at the Program Management level. Risk mitigation funding will be separately managed at the Program Management and Segment Management levels. In general, funding reserves shall be maintained and allocated commensurate with the level of risk exposure determined and based on the expected values (EVs) reported for each risk handling/action approach.

Milestones

- Weekly Management, Systems, and functional area meetings may include status of risks.
- Monthly program meetings shall include status of risks.
- Top Significant Risks for the Overall Program and Segment risk status shall be summarized and reported to the PM on a monthly basis.
- Once a risk has been assigned, the initial set of risks shall be reviewed on a regular basis.

Section 6 Cost and Schedule Reserves, Allowances and Re-scope/Scope Reduction Strategy

Details of the GOES-R Series Program re-scope/scope reduction options shall be documented in the GOES-R Series Integrated Program Management and Acquisition Plan. Should program de-scope be required, the Program Manager will assemble a team comprised of managers and technical leads to review options and proposed de-scope in mission performance, operations, or science. The re-scope/scope reduction process will be carried out in accordance with established Configuration Management (CM) procedures. The ongoing RM process will be applied to the new scope. The cost and other budget information for the GOES-R Series Program is available to the team for design, development, operations, data distribution and launch studies. Additional reserves and allowance funding will be held for mission re-scope/scope reduction options. De-scope options and re-planning are linked to maintaining minimum program requirements. Failure to meet minimum program requirements triggers a program review.

The GOES-R Series Program has implemented a process to ensure that sufficient budget and schedule contingencies are provided and maintained throughout the GOES-R Series Program life cycle. Due consideration shall be given to the use of budget contingency and planned schedule contingency to mitigate program risks. In addition, the GOES-R Series Program shall pursue scope reduction and performance/capability reduction only as a last resort to mitigate risks. The GOES-R Series Program shall include potential scope reduction options and alternatives along with implementation time frames and projected cost-savings, as part of the program acquisition and review process. If other methods of cost containment are not practical, the reductions identified may be exercised; however, any reduction in performance or capability will be implemented only after GOES-R Series PM approval.

Appendix A – Risk Management Information System

APPENDIX A

A-1 Risk Information Sheet (Generic)

A generic Risk Information Sheet (RIS) is provided in Figures A-1 and A-2.

ID	*GOES-R Series Program* *Risk Information Sheet*		Date Identified:
Priority/RAC	Risk Statement (Condition; Consequence)		
Probability			
Impact			
Timeframe	Area/WBS:	Assigned to (Risk Owner):	Date:
Risk Identifier/Originator:		Date Identified:	
Context			
Approach:			
Handling/Action Strategy			
Action Plan and Trigger(s)/Fallback Plan and Trigger(s)			
Status:		Status Date:	
Lessons Learned			
Closing Approval: Signature and Date PM Risk Owner Identifier		Closing Rationale	

Figure A - 1 Risk Information Sheet
(Sheet 1 of 2)

Risk Response Estimating Form

Original Estimate				
WBS	Task	***Technical***	***Cost***	***Schedule***

Risk Identification/Analysis Results (Qualitative/Quantitative):

Risk		Probability	Impact			EV			EU
Condition	Consequences		Technical	Cost	Schedule	(TPM)	(Days)	($)	
Expected Value/Expected Utility of Risk									
Estimate for Work to be Performed (Original Estimate – Expected Value of Risk)									
Total Expected Value/Expected Utility Before Risk Response									

Risk Action Planning (Qualitative/Quantitative)

Risk Response Estimate				
WBS	Task (Add/Remove)	***Technical***	***Cost***	***Schedule***

Risk Action		Probability	Impact			EV			EU
Condition	Consequences		Technical	Cost	Schedule	(TPM)	(Days)	($)	
Expected Value/Expected Utility of Risk After Risk Response									
Estimate for Work to be Performed (Original Estimate – Expected Value of Risk)									
Total Expected Value/Expected Utility After Risk Response									

Notes:

Figure A - 2 Risk Information Sheet
(Sheet 2 of 2)

GOES-R Series Program RIS Definitions

- ID - sequential number prefaced by Organizational code, i.e., NOAA, GOES-R Program, etc.
- Identified by - name of person who identified the risk.
- Priority - number assigned by GOES-R Series Program Manager
- Probability, Impact, Timeframe – defined in Risk Plan
- Statement – single phrase condition/consequence of a risk
- Area/WBS: Area or Work Breakdown Structure element assigned by the Program
- Assigned to and Date: Person who has been assigned to manage the risk and the date the assignment was given
- Context – provide additional information about the risk to ensure that the risk is properly understood
- Handling/Action Strategy – describe realistic, measurable goals for mitigating the risk
- Action/Fallback Plan and Trigger – describe the action plan for mitigating the risk/ if a fallback plan is necessary, describe fallback plan and what trigger (realistic and measurable) should be used should the action plan not be effective.
- Status and Status Date – used to describe a change in status of an identified risk with explanation.
- Approval – signature of person authorizing the acceptance of a risk statement
- Closing Rational and Date: Description of how the risk was mitigated and the date it was removed from active tracking

A-2 Risk Information System Web Site

The RMIS, Figure A-3, is designed to communicate risk information to Program team members. Access to the RMIS is obtained through the current NOAA GOES-R Series Program Homepage, (http://goes-r/******/), shared password for GOES-R Series Program team members. An additional account will provided to administrators for system maintenance.

The RMIS will contain the Risk Information Display Screen (RIDS) and the Risk Tracking Log (RTL). All GOES-R Series Program team members may submit a RIDS using the web-based form. This is the only data input privilege that will be granted. Upon completion of all the required data, the Risk Originator will submit the risk to the RMIS. The RMIS will forward notification of the receipt of the risk submittal to the originator. The RMS will review each submittal for consistency and completeness. If the data provided is complete and format is consistent, the RMS will generate a report of each risk submittal that will establish the Watch List for RMB meeting. For configuration control, the RMIS automatically assigns each new risk/watch item a unique number. If the risk is considered valid, the PM, with input from the RMB, will assign an owner to the risk. The Risk Owner is responsible for implementing the approach (avoidance, control/mitigation, transfer, or accept) to respond to the risk.

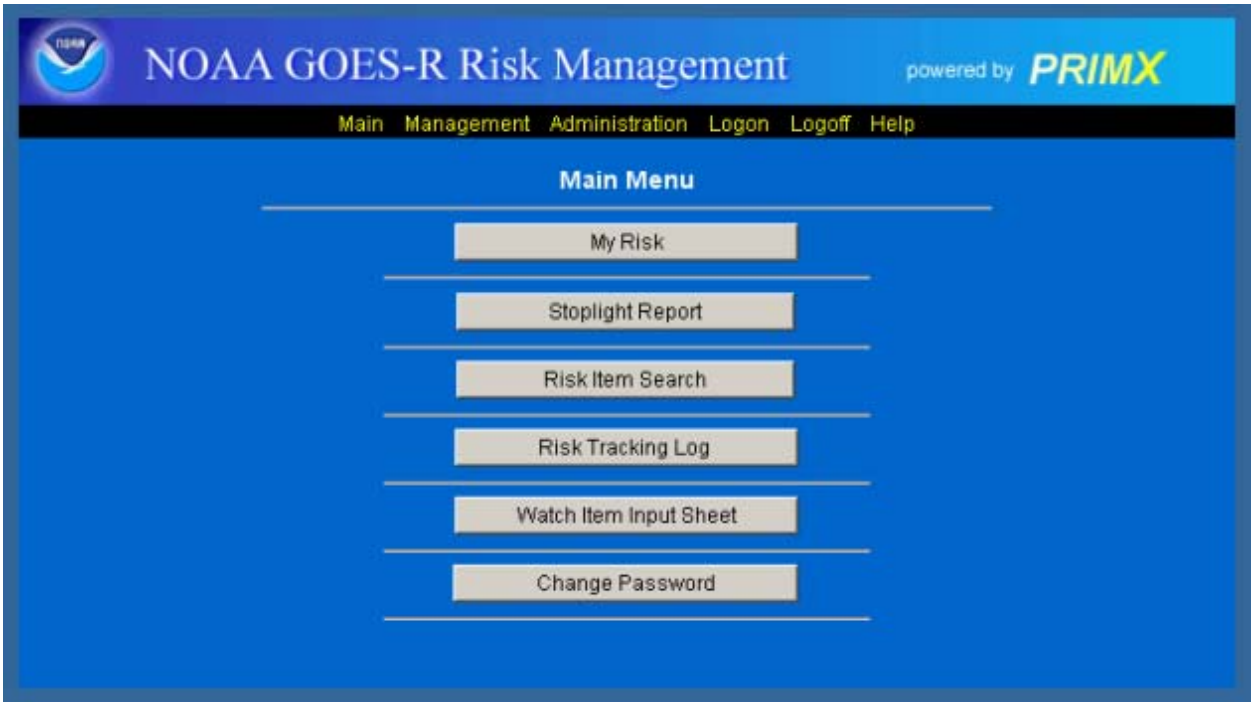


Figure A - 3 Risk Information System Web Site

Two basic reports can be accessed via the RMS, the Risk Tracking Log and the Stop Light Report. The RTL, shown in Figure A-4, will show a running list of all of the risk records.

Figure A - 4 Risk Tracking Log

A-2.1 Risk Identification Sheet Process/Instructions

The RIDS is described in Figure A-5. The form is to be completed as soon as possible after a risk has been identified.

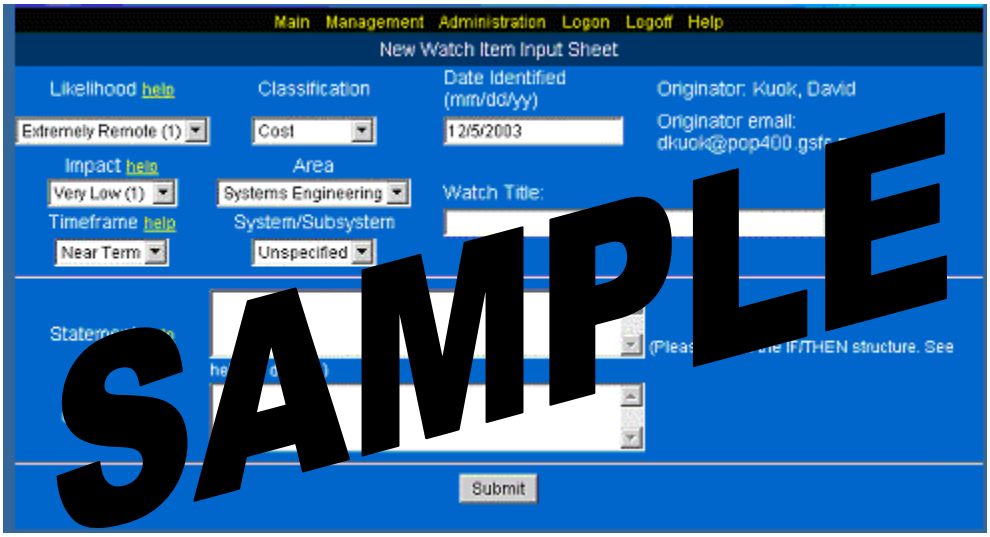


Figure A - 5 Risk Identification Screen

This form is initiated by completing the:

- Date Identified - When the risk was identified
- Risk Title – Originator develop the risk title
- Risk Statement - Statement of the risk consisting of condition and consequence(s)
- Originator - Person or organization that identified the risk
- Context - Associated information supporting the risk. If the originator is aware of any additional risk information at the time of submittal, it is to be made known in order to thoroughly evaluate and process the risk information sheet.
- Probability - The likelihood of risk occurrence
- Impact - The severity if risk should materialize
- Timeframe - Time to start action or mitigation
- Classification - Technical, programmatic, Schedule, or Cost
- Area - Area impacted by the risk (Mission, Program Office, Spacecraft, etc.)

A risk ID number will be automatically assigned to each risk submitted.

A-2.2 RMIS Maintenance

The RMS will contain records for all RMB activity and will keep the RMIS up to date. The Risk Management Coordinator, or designee, will review all risk submittals for completeness and clarity. If the risk submittal is returned as a Watch Item, the RMIS will notify the originator with an explanation. The Risk Management Coordinator will enter the maintenance screen of the RMIS, Figure A-6, to complete the following fields:

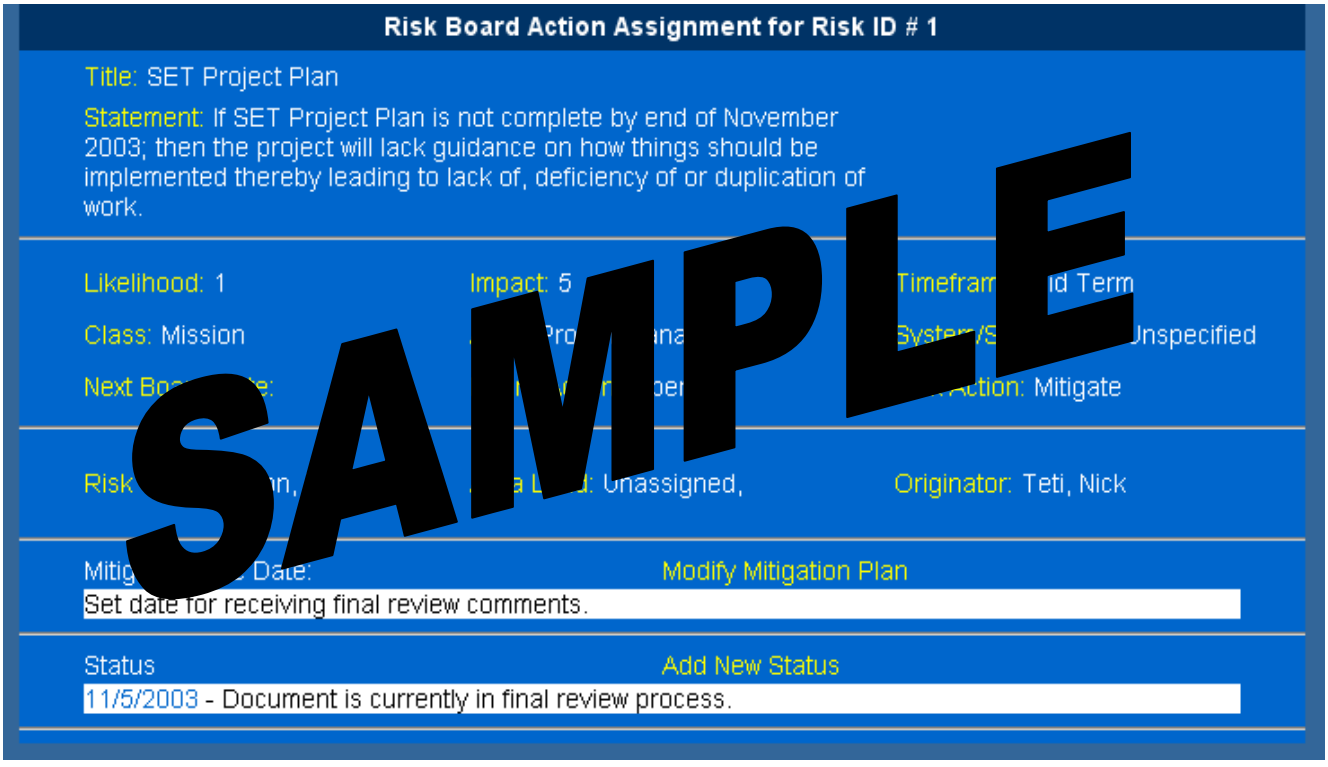


Figure A - 6 Risk Maintenance Screen

- Board Action – Review, Reject, Action Item, Close
- Approach – Avoidance, control/mitigation, transfer, or accept
- Risk Assessment Code/Risk Exposure – Product of Impact times Probability
- Assigned Owner – Person responsible for the risk action
- Owner E-mail Address – E-mail address for risk owner

- Assigned Lead – Organization lead for owner
- Assigned Lead E-Mail – E-mail address for assigned lead
- Accept/Acceptance Rational – RMS records the rational for accepting a risk
- Research/Due Date – RMS records a description of the research to be performed and the date due
- Watch/Trigger – RMS records the trigger (event and/or date) that could cause a change in status for the risk or WI
- Mitigate/Action Due/Mitigation Plan Source File – RMS records a description of the mitigation approach and a due date for the action plan. Additional planning data will be recorded in the form of an attachment. The cognizant Program or Segment Manager is responsible for approving mitigation plans
- Risk Management Coordinator Notes (Current Status)/Notes as of – The RMS records the status and status date.
- Closure Approved by - PM signature or designee
- Date Signed – Date risk closed by PM
- Candidate for Lessons Learned –PM to note if candidate for lessons learned

Appendix B – Abbreviations and Acronyms

AA	Archive & Access
DRR	Design/Risk Reduction
C3	Command, Control, and Communication
CM	Configuration Management
CONOPS	Concept of Operations
EELV-M	Evolved Expendable Launch Vehicle – Medium
EV	Expected Value
GFE	Government Furnished Equipment
GOES	Geostationary Operational Environmental Satellite
GPRD	GOES-R Series Program Requirements Document
IPM/AP	Integrated Program Management & Acquisition Plan
GORWG	GOES-R Series Operational Requirements Working Group
IPT	Integrated Product Team
ISO	International Standards Organization
ITAR	International Traffic in Arms Regulation
KPP	Key Performance Parameter
MCDM	Multi-Criteria Decision Making
MRD	Mission Requirements Document
NCR	Non-Conformance Reporting
NESDIS	NOAA National Environmental Satellite, Data, and Information Service
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OSD	Office of Satellite Development
PGD	Product Generation & Distribution
PM	Program Manager
PMR	Program Management Review
PR	Program Risk
PRA	Probabilistic Risk Assessment
PRIMX	Program Risk Information Management exchange
RAC	Risk Assessment Classification
RBD	Reliability Block Diagram
RIDS	Risk Information Display Screen
RIS	Risk Information Sheet
RM	Risk Management
RMB	Risk Management Board
RMIS	Risk Management Information System
RMP	Risk Management Plan
RMWG	Risk Management Working Group
RO	Risk Owner
RTL	Risk Tracking Log
SD/P	System Development/Production
SM	Segment Management
TBQ	Taxonomy Based Questionnaire
TOC	Total Ownership Cost
TPM	Technical Performance Measurement
TPP	Technical Performance Parameter
WI	Watch Item
WMO-EOS	World Meteorological Organization – Earth Observing System